

Having described the invention, the following is claimed:

1. A method of processing a tube, said method comprising the steps of:
  - moving a first portion of the tube into a work station,
  - cutting the first portion of the tube into a first plurality of sections,
  - receiving a scrap section on which an end of the first portion of the tube is disposed at a scrap receiving location,
  - receiving sections of the first portion of the tube other than the scrap section at a second receiving location which is separate from the scrap receiving location,
  - moving a second portion of the tube into the work station,
  - cutting the second portion of the tube into a second plurality of sections, and
  - directing the second plurality of sections to the second receiving location which is separate from the scrap receiving location.
2. A method as set forth in claim 1 wherein said step of cutting the first portion of the tube into a first plurality of sections includes forming an end surface on the second portion of the tube, said step of moving the second portion of the tube into the work station is performed with the end surface on the second portion of the tube leading.

3. A method as set forth in claim 1 further including the step of pressing an end of the first portion of the tube against a stop surface under the influence of force transmitted from the second portion of the tube to the first portion of the tube during cutting of the first portion of the tube.

4. A method as set forth in claim 1 further including the steps of pressing the end of the first portion of the tube against a stop surface with the stop surface in a first position during cutting of the first portion of the tube into a first plurality of sections, moving the stop surface to a position spaced from the first position, said step of cutting the second portion of the tube includes pressing an end of the second portion of the tube against the stop surface with the stop surface in a position spaced from the first position.

5. A method as set forth in claim 1 further including the step of rotating the tube about a longitudinal central axis of the tube during performance of said steps of moving the first portion of the tube into the work station, cutting the first portion of the tube, moving the second portion of the tube into the work station, and cutting the second portion of the tube.

6. A method as set forth in claim 1 wherein said step of moving the first portion of the tube into the work station includes moving the first portion of the tube along a longitudinal central axis of the tube, said step of moving a second portion of the tube into the work station includes moving the second portion of the tube along the longitudinal central axis of the tube.

7. A method as set forth in claim 1 further including the step of moving the second portion of the tube in a direction away from the work station after performing said step of cutting the first portion of the tube and prior to performance of said step of moving the second portion of the tube into the work station.

8. A method as set forth in claim 1 further including the step of moving the first end portion of the tube and a mandrel into a telescopic relationship in which the mandrel is disposed inside the first portion of the tube, rotating the mandrel while the tube and mandrel are in a telescopic relationship, and rotating the tube at the same speed as the mandrel while the tube and mandrel are in a telescopic relationship, said step of rotating the tube at the same speed as the mandrel includes applying force to the tube at a location spaced from the mandrel.

9. A method as set forth in claim 1 wherein said step of moving a first portion of the tube into the work station includes moving the tube along a longitudinal central axis of the tube, reducing the speed of movement of the tube along its longitudinal central axis, and engaging a stop surface with a leading end of the tube after reducing the speed of movement of the tube.

10. A method as set forth in claim 9 further including the step of pressing the leading end of the tube against the stop surface during cutting of the first portion of the tube into a first plurality of sections.

11. A method as set forth in claim 1 wherein said step of moving the first portion of the tube into the work station includes simultaneously moving the tube along its central axis and rotating the tube about its central axis.

12. A method as set forth in claim 1 further including the step of rotating the first and a second portions of the tube about a longitudinal central axis of the tube during cutting of the first portion of the tube.

13. A method as set forth in claim 1 wherein said step of moving the first portion of the tube into the work station includes operating a feed assembly to move the tube along its longitudinal central axis.

14. A method as set forth in claim 13 wherein said step of moving the first portion of the tube into the work station includes rotating the tube about its longitudinal under the influence of force transmitted from the feed assembly to the tube.

15. A method as set forth in claim 1 wherein said step of moving the first portion of the tube into the work station includes engaging the tube with a plurality of feed rollers and rotating the feed rollers to move the tube along a longitudinal central axis of the tube under the influence of force applied to the tube by the feed rollers.

16. A method as set forth in claim 15 wherein said step of rotating the feed rollers to move the tube along the longitudinal central axis of the

tube includes rotating at least one of the feed rollers about an axis which is skewed relative to the longitudinal central axis of the tube.

17. A method as set forth in claim 15 wherein said step rotating the feed rollers to move the tube along the longitudinal central axis of the tube includes rotating a first feed roller about a first axis which is skewed relative to the longitudinal central axis of the tube and rotating a second feed roller about a second axis which is skewed relative to the longitudinal central axis of the tube.

18. A method of processing a tube, said method comprising the steps of:

moving a tube in a first direction along its longitudinal central axis to move a first portion of the tube into a work station,

rotating the tube about its longitudinal central axis during movement of the first portion of the tube into the work station,

cutting the first portion of the tube into a first plurality of sections,

rotating the tube about its longitudinal central axis during cutting of the first portion of the tube,

moving the tube in the first direction along its longitudinal central axis to move a second portion of the tube into the work station,

cutting the second portion of the tube into a second plurality of sections, and

rotating the tube about its longitudinal central axis during cutting of the second portion of the tube.

19. A method as set forth in claim 18 further including the step of moving the tube in a second direction along its longitudinal central axis after performing said step of cutting the first portion of the tube into a plurality of sections and prior to performance of said step of moving the tube in the first direction along its longitudinal central axis to move a second portion of the tube into the work station.

20. A method as set forth in claim 18 wherein said step of rotating the tube about its longitudinal central axis during moving of the first portion of the tube into the work station includes applying force to the tube at a plurality of locations which are spaced from the work station, said step of rotating the tube about its longitudinal central axis during cutting of the first portion of the tube includes applying force to the tube at a plurality of locations which are spaced from the work station.

21. A method as set forth in claim 18 wherein said step of moving the tube in a first direction along its longitudinal central axis to move a first portion of the tube into the work station includes transmitting force to the tube by rotating a plurality of rollers while the plurality of rollers are disposed

in engagement with the tube, said step of rotating the tube about its longitudinal central axis during movement of the first portion of the tube into the work station includes transmitting force from the plurality of rollers to the tube.

22. A method as set forth in claim 18 wherein the first plurality of sections includes a scrap section on which an end of the first portion of the tube is disposed, said method further includes receiving the scrap section at a scrap receiving location, and receiving sections of the first portion of the tube other than the scrap section at a second receiving location which is separate from the scrap receiving location.

23. A method as set forth in claim 18 wherein said step of moving the tube in the first direction along its longitudinal central axis to move a first portion of the tube into the work station includes moving a leading end of the first tube into the work station at a first speed, reducing the speed at which the leading end of the tube moves into the work station to a second speed which is less than the first speed, and moving the leading end of the tube into engagement with a stop while the leading end of the tube is moving at the second speed.

24. A method as set forth in claim 18 further including the steps of rotating a mandrel about an axis which is coincident with the longitudinal central axis of the tube, and moving the mandrel and tube into a telescopic

relationship while rotating the mandrel and tube at the same speed about the longitudinal central axis of the tube.

25. A method as set forth in claim 18 wherein said steps of moving the tube in the first direction along its longitudinal central axis to move the first portion of the tube into the work station and rotating the tube about its longitudinal central axis during movement of the first portion of the tube into the work station include engaging the tube with a plurality of sets of rollers and rotating the rollers in each set of rollers about axes which are skewed relative to each other and are skewed relative to the longitudinal central axis of the tube.

26. A method as set forth in claim 18 wherein said step of moving the tube in a first direction along its longitudinal central axis includes engaging the tube with a plurality of feed rollers and rotating the feed rollers to move the tube along a longitudinal central axis of the tube under the influence of force applied to the tube by the feed rollers.

27. A method as set forth in claim 26 wherein said step of rotating the feed rollers to move the tube along the longitudinal central axis of the tube includes rotating at least one of the feed rollers about an axis which is skewed relative to the longitudinal central axis of the tube.

28. A method as set forth in claim 26 wherein said step of rotating the feed rollers to move the tube along the longitudinal central axis of the



tube includes rotating a first feed roller about a first axis which is skewed relative to the longitudinal central axis of the tube and rotating a second feed roller about a second axis which is skewed relative to the longitudinal central axis of the tube.

29. A method of processing a tube, said method comprising the steps of:

moving a tube in a first direction along its longitudinal central axis to move a first portion of the tube and a mandrel into a telescopic relationship at the work station,

pressing an end of the first portion of the tube against a stop surface at the work station,

cutting the first portion of the tube into a first plurality of sections while continuing to press the end of the first portion of the tube against the stop surface and while the first portion of the tube and the mandrel are in a telescopic relationship, said step of cutting the first portion of the tube includes forming an end of a second portion of the tube,

moving the second portion of the tube along its longitudinal central axis in a direction opposite to the first direction to move the second portion of the tube away from the first portion of the tube after performing said step of cutting the first portion of the tube,

withdrawing the mandrel from the plurality of sections formed by cutting the first portion of the tube,

moving the second portion of the tube along its longitudinal central axis to move the second portion of the tube and the mandrel into a telescopic relationship at the work station,

pressing the end of the second portion of the tube against the stop surface at the work station, and

cutting the second portion of the tube into a second plurality of sections while continuing to press the end of the second portion of the tube against the stop surface and while the second portion of the tube and mandrel are in a telescopic relationship.

30. A method as set forth in claim 29 wherein said step of moving the first portion of the tube and the mandrel into a telescopic relationship includes moving the first portion of the tube along the mandrel as the first portion of the tube moves in the first direction along its longitudinal central axis.

31. A method as set forth in claim 29 wherein said step of moving the first portion of the tube and the mandrel into a telescopic relationship includes moving the mandrel along the central axis of the tube in the direction opposite to the first direction.

32. A method as set forth in claim 29 wherein said step of moving the first end portion of the tube and the mandrel into a telescopic relationship includes simultaneously moving the tube in the first direction along its longitudinal central axis and moving the mandrel along the central axis of the tube in the direction opposite to the first direction.

33. A method as set forth in claim 29 wherein said step of cutting the first portion of the tube into a plurality of sections includes forming a scrap section on which an end of the first portion of the tube is disposed, said method further includes the steps of receiving the scrap section at a scrap receiving location, and receiving sections of the first portion of the tube other than the scrap section to a second receiving location which is separate from the scrap receiving location.

34. A method as set forth in claim 23 wherein said step of moving the first portion of the tube and the mandrel into a telescopic relationship is performed while rotating the tube and the mandrel at the same speed and in the same direction about a longitudinal central axis of the tube.

35. A method of processing a tube, said method comprising the steps of:

moving a tube along its longitudinal central axis to move a first portion of the tube into a work station,

rotating the tube about its longitudinal central axis during movement of the first portion of the tube into the work station,

rotating a mandrel, disposed the work station, about the longitudinal central axis of the tube,

moving the first portion of the tube and the mandrel into a telescopic relationship with the mandrel inside the first portion of the tube while rotating the tube about its longitudinal central axis and while rotating the mandrel about the longitudinal central axis of the tube,

cutting the first portion of the tube into a first plurality of sections at the work station while the first portion of the tube and the mandrel are disposed in a telescopic relationship and while rotating the tube and the mandrel about the longitudinal central axis of the tube,

receiving a scrap section on which an end of the first portion of the tube is disposed at a scrap receiving location,

receiving sections of the first portion of the tube other than the scrap section at a second receiving locating which is separate from the scrap receiving location,

moving the tube along its longitudinal central axis to move a second portion of the tube into the work station after performing said step of cutting the first portion of the tube,

rotating the tube about its longitudinal axis during movement of the second portion of the tube into the work station,

moving the second portion of the tube and the mandrel into a telescopic relationship with the mandrel inside the second portion of the tube while rotating the tube about its longitudinal central axis and while rotating the mandrel about the longitudinal central axis of the tube,

cutting the second portion of the tube into a second plurality of sections at the work station while the second portion of the tube and the mandrel are disposed in a telescopic relationship and while rotating the tube and the mandrel about the longitudinal central axis of the tube, and

receiving the second plurality of sections at the second receiving location which is separate from the scrap receiving location.

36. A method as set forth in claim 35 further including the steps of pressing the end of the first portion of the tube against a stop surface at the work station while performing said step of cutting the first portion of the tube, and pressing an end of the second portion of the tube against the stop surface at the work station while performing said step of cutting the second portion of the tube.

37. A method as set forth in claim 36 wherein said step of pressing the end of the first portion of the tube against the stop surface while cutting the first portion of the tube is performed with the stop surface in a first

position, said method further includes moving the stop surface to a second position, said step of cutting the second portion of the tube includes pressing an end of the second portion of the tube against the stop surface with the stop surface in the second position.

38. An apparatus for use in processing a tube, said apparatus comprising:

- a feed assembly which is operable to move the tube along its longitudinal central axis to move a first portion of the tube into a work station,

- a mandrel disposed at the work station and having a central axis which is aligned with the longitudinal central axis of the tube as the first portion of the tube is moved into the work station by said feed assembly, said mandrel and first portion of the tube being movable into a telescopic relationship at the work station,

- a plurality of annular knives disposed in a linear array and rotatable about an axis extending parallel to the longitudinal central axis of the tube,

- a first drive assembly which is connected with said annular knives and is operable to rotate said annular knives about an axis which extends parallel to the longitudinal central axis of the tube, and

a second drive assembly which is connected with said linear array of annular knives and is operable to move said annular knives into engagement with the first portion of the tube to cut the first portion of the tube into a plurality of sections while said mandrel is disposed in a telescopic relationship with the first portion of the tube and while said annular knives are being rotated by said first drive assembly.

39. An apparatus as set forth in claim 38 further including a scrap receiving location disposed at said work station and at which a scrap section of the first portion of the tube is received, and a second receiving location at which a plurality of sections of the first portion of the tube are received.

40. An apparatus as set forth in claim 38 further including a stripper having a surface against which an end of said first portion of said tube is pressed under the influence of force transmitted from said feed assembly, said stripper and mandrel being relatively movable to disengage from said mandrel the plurality of sections formed by cutting the first portion of the tube.

41. An apparatus as set forth in claim 38 wherein said feed assembly is operable to rotate the tube about its longitudinal central axis as the tube is moved along its longitudinal central axis by said feed assembly.

42. An apparatus as set forth in claim 38 wherein said feed assembly includes a plurality of feed rollers which engage the tube and a

drive assembly which is operable to rotate at least one of said feed rollers to move the tube along a longitudinal central axis of the tube under the influence of force transmitted to the tube from at least said one feed roller.

43. An apparatus as set forth in claim 38 wherein said feed assembly includes a plurality of feed rollers which are rotatable about axes which are skewed relative to the longitudinal central axis of the tube to rotate the tube about its longitudinal central axis and to move the tube along its longitudinal central axis.

44. An apparatus as set forth in claim 38 wherein said feed assembly includes a plurality of feed stands disposed in a linear array, each of said feed stands includes a plurality of feed rollers having surfaces which are engagable with the tube to transmit force to the tube to move the tube along its longitudinal central axis and to rotate the tube about its longitudinal central axis.

45. A method of processing a tube, said method comprising the steps of:

moving a tube along its longitudinal central axis to move at least a first portion of the tube into a work station,

rotating the tube about its longitudinal central axis during movement of the first portion of the tube into the work station,



rotating a mandrel, disposed the work station, about the longitudinal central axis of the tube,

moving the first portion of the tube and the mandrel into a telescopic relationship,

cutting tube into at least first and second sections with at least one knife while the tube and the mandrel are disposed in a telescopic relationship and while rotating the tube and the mandrel about the longitudinal central axis of the tube, and

pressing an end of the first portion of the tube against a stop surface at the work station while performing said step of cutting the tube.

46. A method as set forth in claim 45 wherein said step of cutting the tube into at least first and second sections includes forming an end surface on a second portion of the tube, said method further includes the step of moving second portion of the tube into the work station with the end surface on the second portion of the tube leading.

47. A method as set forth in claim 45 wherein the step of pressing an end of the first portion of the tube against a stop surface is performed under the influence of force transmitted from a second portion of the tube to the first portion of the tube.

48. A method as set forth in claim 45 further including the step of moving the stop surface from a first position to a second position spaced from

the first position, said step of cutting the second portion of the tube includes pressing an end of the second portion of the tube against the stop surface with the stop surface in the second position.

49. A method as set forth in claim 45 further including the step of moving a second portion of the tube in a direction away from the work station after performing said step of cutting the first portion of the tube.

50. A method as set forth in claim 45 wherein said step of moving a first portion of the tube and the mandrel into a telescopic relationship includes reducing the speed of movement of the tube along its longitudinal central axis, and engaging the stop surface with a leading end of the tube after reducing the speed of movement of the tube.

51. A method as set forth in claim 45 wherein said step of moving the first portion of the tube into the work station includes engaging the tube with a plurality of feed rollers and rotating the feed rollers to move the tube along a longitudinal central axis of the tube under the influence of force applied to the tube by the feed rollers.

52. A method as set forth in claim 51 wherein said step of rotating the feed rollers to move the tube along the longitudinal central axis of the tube includes rotating at least one of the feed rollers about an axis which is skewed relative to the longitudinal central axis of the tube.

53. A method as set forth in claim 51 wherein said step rotating the feed rollers to move the tube along the longitudinal central axis of the tube includes rotating a first feed roller about a first axis which is skewed relative to the longitudinal central axis of the tube and rotating a second feed roller about a second axis which is skewed relative to the longitudinal central axis of the tube.